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ABSTRACT

In order to further define the role of information centers in institutional research activities, two hypotheses are advanced: there are distinctive markets for information center activities within the university; and different services, products and delivery mechanisms are needed to serve each market. Following a discussion of the evolution of the information center concept, the following topics are covered: (1) new-style vs. old-style information centers; (2) understanding information markets: an analysis of requests to an old-style information center; (3) trends in information delivery; and (4) developing targeted reporting systems (the routine clerical market, the complex clerical market, and the decision support market). 11 references. (KM)

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Designing an Information Center: An Analysis of Markets and Delivery Systems

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Since 1980, an important concept in data processing has been the information center, an organization especially designed for rapid response to users' information needs. Several authors have suggested that the information center can and should be an institutional research function. Lasher (1983) called attention to the information center as a way of responding to the challenge of microcomputing on campus. Stevenson and Walleri (1983) detailed the rationale for an information center as an institutional research activity and outlined roles an information center might play in institutional planning. Staman and Litaker (1985) described a process for implementing an information center as part of an institutional research office, including practical issues of staffing, space, and equipment. The purpose of this paper is to further define the role of information centers in institutional research activities. The paper advances two hypotheses: (1) There are distinctive markets for information center activities within the university and (2) different services, products, and delivery mechanisms are needed to serve each market.

The discussion draws from two sources. The market segmentation hypothesis derives from an analysis of seven years of requests to a student information center at the University of Minnesota, Twin Cities. The discussion of delivery mechanisms draws from an area at the cutting edge of information delivery technology—demographic analysis systems for market planning.

Background: The Evolution of the Information Center Concept

Information centers differ considerably in their activities, organization, and tools. There is, however, a core set of characteristics shared by almost all (Martin 1982; Dooley, 1985):

- The purpose of an information center is to facilitate the *rapid retrieval* of data to meet *ad hoc* information requests.
- The center relies on *special reporting data bases*, apart from operational data bases. These data bases are usually relational and structured for fast and economical retrieval of data for individual subgroups.
- Data are retrieved and manipulated using *fourth-generation (4GL) computer languages*, which use English-like commands and macro procedures to execute many individual operations at once. Examples include NOMAD, FOCUS, and AS.
- The center gives *end users direct access to data*, allowing them to manipulate the data themselves in order to answer their own questions.
- The center *consults with users* on questions of hardware, software, and analysis techniques.

The idea of information centers has gained momentum in data-processing circles. Information centers have

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appeared in all types of organizations, public and private, large and small. Information center staff have their own professional association, journal, and conferences.

Two factors came together to fuel the information center movement: an increasing backlog of information requests to data-processing departments and the microcomputer revolution. End users were demanding more information applications at the same time they were gaining the tools to develop their own applications. The information center was a natural response.

New-Style vs. Old-Style Information Centers

Institutional researchers may question the notion that information centers are really a new idea. Many would argue that institutional research offices have been information centers for a long time. The argument has merit. Dooley (1985) quotes Theodore Kline, a consultant on end-user computing:

> Information center concepts are really a continuation of an internal consulting staff; they have been around for 15 or 20 years. They have been called everything from management science, management services, operations analysis to decision support services; the term information center is just a description of service to end-users. (p. 18)

An examination of the characteristics of information centers shows that several have been traditional institutional research functions. Certainly, rapid response to ad hoc information requests (especially from central administrators) has been a hallmark of most institutional research offices. Institutional researchers are also old hands at using extract data files and statistical software packages, which can be thought of as a type of 4GL. Finally, institutional researchers have, by definition, been oriented toward end users. Most consult with administrators on the nature of their information needs, data analysis techniques, and the meaning and implications of data.

The main difference between traditional institutional research functions and those of the information center is the emphasis on microcomputing and direct data manipulation by end users. Until recently, most institutional research offices were what might be termed "old style" information centers.

Old-style information centers are those which respond rapidly to ad hoc requests by having their own staff retrieve and/or analyze data for users. In contrast, "new style" information centers emphasize direct data retrieval and analysis by end users. The question for institutional research offices is not so much whether they should become information centers but the degree to which they should move from being old-style information centers to being new-style information centers. The remainder of this paper considers specific ways in which institutional research offices can take on new-style information center functions.

Understanding Information Markets: An Analysis of Requests to an Old-Style Information Center

In 1976, the Admissions and Records Office of the University of Minnesota developed a pioneering information center for student record information, the Data Retrieval Center—now called Data and Reporting Services (DRS). The center was designed to permit fast ad hoc retrievals of student record information at a low cost. It was instituted because the production data files of student record information were not structured for economical ad hoc inquiry about subgroups. The center has its own programmers and a low flat-rate billing policy.

The center has had all the characteristics of the old-style information center. It has used special mainframe reporting data bases (built with the SYSTEM 2000 database management system), set up to retrieve subgroup data easily. Early fourth-generation query languages (SYSTEM 2000 Reportwriter & Plex) and analysis statistical packages (SAS & SPSS) are used. A major staff activity has always been consulting with users to refine their needs and to educate them with regard to the possibilities and problems connected with using student record data.

The center is now dealing with the transition from old-style to new-style information center. During the past year, the office has been cooperating with the university's administrative computing center to make its reporting data bases directly accessible to users through a more recent fourth-generation language product, Application System (AS) from IBM.

The center has been in existence long enough to yield an empirically based analysis of the student information needs of various groups on campus. The center has kept track of each request, including who made the request and what kind of information was requested. These request records are a useful source of data for understanding the markets for information center services, and they form the basis for the directions recommended at the end of this paper.

The analyses are based in 1,522 requests made to DRS during fiscal years 1981 through 1987. Earlier data are not included because they were judged to be less useful for understanding recent request trends. Also not included are records of reports generated by users themselves through the 4GL.

Figure 1 shows the total number of requests made to DRS, broken out by calendar year. It illustrates the trend that is found in almost all organizations: More people want more information.

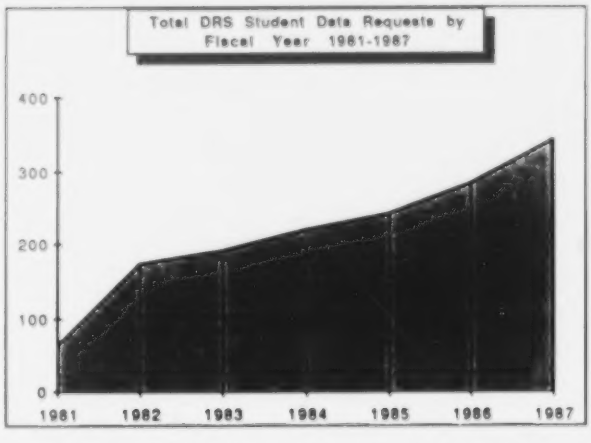

Figure 1. Total DRS student data requests by fiscal year, 1981-1987

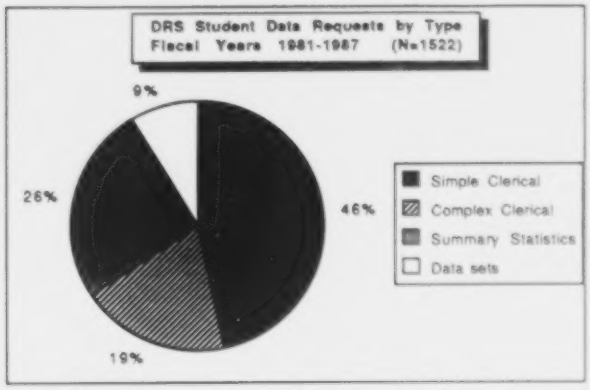

Figure 2. DRS student data requests by type, fiscal years 1981-1987

Figure 2 shows the total volume of requests broken out by request type. For this analysis, requests were categorized into four types defined as follows:

1. *Routine clerical.* Requests which require straightforward listings of current information for subgroups of individual cases (students) defined with preexisting selection criteria such as class or major. These requests do not require recomputations or complex formatting and are typically accomplished in under two hours. Examples are mailing label/list requests for a department and honors/probation reports listing students in order of GPA for a college.
2. *Complex clerical.* Requests which ask for reports on individual cases but require complex formats (several variables on a page), selection criteria (multiple or calculated criteria), or calculations (computing new variables). These reports typically require more than two hours of programming. Examples are stratified random samples, degree progress reports which compare students' coursework against degree requirements, and probation reports using multiple performance indices.
3. *Summary statistics.* Requests which require summary statistics rather than reports of individual cases. These requests require the use of statistical procedures, ranging from routine crosstabs to complex regression and log-linear analyses. Examples include demographic profiles and retention/GPA reports for student subgroups.
4. *Data sets.* Requests which ask for individual case data in machine-readable form. The data sets range from small sets downloaded to microcomputers to very large sets put on tape for mainframe applications.

Some requests required more than one type of output. In these cases, the decision rule was to classify the requests upward in the sequence. For example, if a request was for both a roster and summary statistics, it was classed in the statistics category. If it asked for statistics and a data set, it was classed as a data set request. Each request was counted only once.

The figure shows that, over the seven-year period, the office's workload was fairly evenly split between routine clerical requests and the other types of requests. Summary statistics, the traditional institutional report, account for only a quarter of the requests. The other three-quarters of requests ask for data about individual cases. Up to this point, downloaded data sets have been a very small proportion of the office's output, although these figures do not count recent activity by users of the 4GL system.

Figure 3 continues the analysis of request types by showing the trends in request types by year. The key trends have been a steady flow of routine clerical requests and an increase in complex clerical and statistics requests.

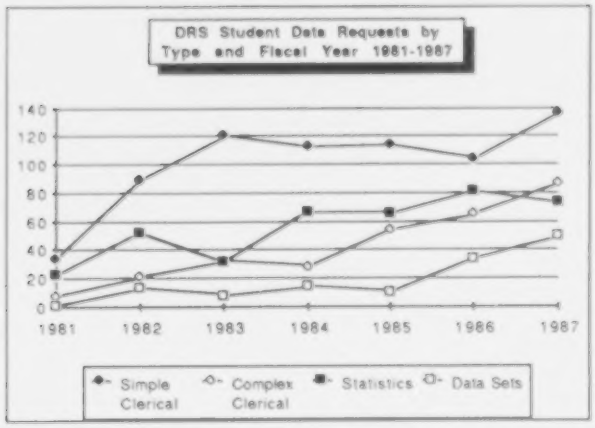

Figure 3. DRS student data requests by type and fiscal year, 1981-1987

Figure 4 shows a different way of segmenting the information center market, by type of requester. The most frequent requesters of student data were academic units, constituent colleges, and departments. At a large university, the college-level administrative offices do much of the tracking of students and programming for them, explaining why college offices were the single biggest information user. Again, the traditional institutional research market, central administrators, was much less of a factor in this information center market.

Of the remaining categories, the SSS internal category refers to other units in the center's parent organization, Student Support Services, including admissions, the registrar's office, and financial aid; "student services" refers to other units under the vice president for student affairs; "branch campuses" covers all requests made from the university's coordinate campuses; and "student groups" includes fraternities, honoraries, and other student organizations.

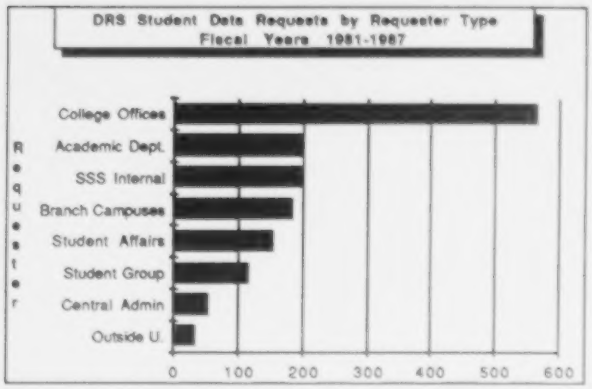

Figure 4. DRS student data requests by requester type, fiscal years 1981-1987.

After looking at markets segmented separately by request and requester type, the next logical step is to put the two segmentations together. Figure 5 shows the distribution of request types by requester type. Note that the chart is a 100% type. Each shading represents the percentage of a requester's total number of requests which is of a certain type.

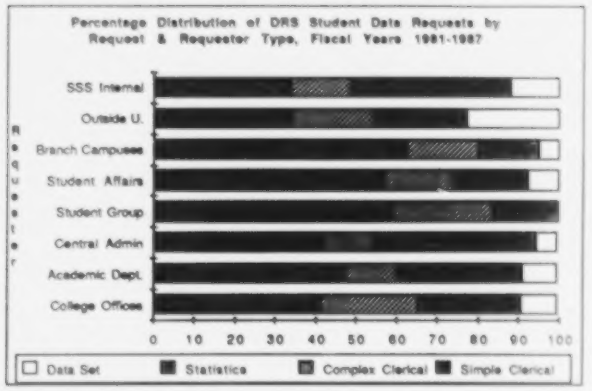

Figure 5. Percentage distribution of DRS student data requests by request and requester type, fiscal years 1981-87.

Figure 5 gives clues as to what kinds of campus users need what kinds of information. College offices, the most frequent requesters, are information omnivores—requesting a balance of all types. Academic departments also share the balance. Central administrative offices, as might be expected, rely heavily on summary statistics. Student affairs, the branch campuses, and student groups represent the opposite pole, requiring primarily routine clerical lists and labels.

To summarize the trends suggested by the analysis, it is clear that the student information business is flourishing. The total number of requests has been steadily increasing, even in the face of the implementation of a user-accessible reporting system. The clients of the information center include all the major campus constituencies, with the bulk of the requests being for individual case data, either routine or complex.

Trends in Information Delivery: Lessons from the Leading Edge

The issue for an institutional research office is to define its role in the "bull market" for information that is likely to exist on campus. Among the questions to be considered are these: How can the institutional research office help meet the demand for direct access to data? Whose information needs should it try to meet, and how should it meet them? To what extent should the institutional research office provide technical support for fourth-generation language users?

In addressing these questions, it is instructive to consider the changes in delivery technology which have taken place in an area which may be the state of the art in information centers—demographic data services. The demographic data industry has grown from a $5 million-a-year industry in the mid-1970s to a $30-$50 million-a-year industry in the mid-1980s (Riche, 1985). Most major companies rely heavily on demographic data in making site and marketing decisions. For this reason, demographic analysis systems are often cited as examples of successful decision support systems (for example, Sprague and Carlson, 1985).

What have been the trends in demographic data technology? As described by Riche (1985), there has been a rapid succession of technologies for delivering demographic data. Before the early 1980s, demographic data services were old-style information centers, offering clients data retrievals conducted by programming staff. Driven by users' desires for lower costs and more control, the services moved to giving users on-line access to the reporting data bases. As microcomputers became available, many users pressed for downloaded data sets. Their motives were very businesslike. For frequent users, the costs of downloading are lower than the on-line charges made for direct access to the data bases.

The biggest technological drawback to the microcomputer analysis of demographics has been the limitation of file size imposed by microcomputer storage technology. This problem is being rapidly overcome by the development of optical disk technology (Foster, 1985). One firm, National Decisions System, has begun to offer an optical disk data base with 300,000 pages of census and other demographic information. While the costs of the optical disk technology are still relatively high, they are already following the course of other computer technologies and quickly dropping.

Today, all three types of delivery mechanism—professionally programmed retrievals, on-line access, and downloading are offered in the marketplace and used by different customers. Occasional users tend to use programmed retrievals and on-line services. Frequent users tend to use the downloaded data. The trend

is definitely toward the use of microcomputers, especially as the computers become more powerful and storage becomes more capacious.

Along with the trend toward microcomputing, there is another trend, cutting across all segments of the demographic data industry: a growing need for analysis and interpretation services. Riche (1985) quotes Edward Spar, president of the Market Statistics data firm:

> While technological change is a great opportunity for the industry, the important thing is still what you're going to do with the data. The big breakthrough will be in analytical retrieval: numbers in a format you can make decisions with. . . . We try to find out what the client's problem is. . . . We tailor a data base to the client's problems, then sit down with a printed report and explain what the data mean. (p. 26)

Riche also quotes spokesmen for two other firms:

1. Dan Huck of CACI:

> Our approach now is to provide more consulting. We have hired more market researchers. There is a big demand for more service in interpreting and applying the data. (p. 26)

2. James Paris of Urban Decision Systems:

> I think the industry has to do some educating. People buy numbers and don't know how to use them. (p. 26)

It is important to note that the consultation being offered by the demographic data firms is different from the consultation services most often mentioned in discussions of information centers. When those with a data-processing background (e.g., Torger, 1983) discuss consulting, they are usually referring to helping users master their hardware and software. They are not referring to analytical consultations on the meaning of the data.

It is this area of analytical consultation and service, not technical consultation, that provides the unique window of opportunity for the institutional research office. Circumstances may lead an institutional research office to become the technical resource center on its campus, but often the technical support role is better served by computer center personnel. The unique expertise of an institutional research office is its understanding of data. The question for the institutional research office is how to deliver this understanding in an environment where users are directly accessing the data.

Conclusion: Develop Targeted Reporting Systems

The distinctive role for an institutional research office aspiring to be a new-style information center is in the development of *reporting systems*. Development of a reporting system is different from the development of reports, the function of an old-style information center. A reporting system allows users to run their own reports, on their own schedule, and without the intervention of programmers or research staff.

A reporting system is also more than a computer system. The focus of the data-processing approach to information centers has been on computer systems, installing fourth-generation language software and microcomputers to allow access to data. Data accessibility and easy-to-use software are necessary but not sufficient conditions for a reporting system.

The DRS experience with a 4GL computer system and reporting data bases has been that installing the software and training people to use it has not been enough. While a small core of frequent users has become fairly adept at using the system, less frequent users, especially higher level administrators, don't use the system enough to be able to create useful reports when they need them. Further, even experienced users have difficulties with some of the lacunas and quirks in the data, such as data elements which are only partially maintained and data which mean different things for different units.

What are needed are reporting systems which make the easy-to-use computer systems still easier to use and which protect users from making unknowing definitional and analytical mistakes. The request records cited earlier suggest that there are three distinctive markets for student data, and perhaps for other kinds of institutional data as well. We hypothesize that each market is best served with a distinct reporting system.

The routine clerical market. The largest market for information services on campus is for straightforward list processing. This is the "blue collar" market, populated primarily by departmental and collegiate clerical staffs. The primary need of this market is to produce listings of information on subgroups of individual cases (student, faculty, facilities) ordered in a variety of ways. Typically, the offices in this market are understaffed and underfunded. They want cheap and effective ways of lightening their large workloads of mailings and required reports.

For this market, an optimal reporting system is likely to be based on standard downloads to microcomputers of selected summary information on the cases of interest to the requesting office. Accompanying the downloads would be software templates for producing basic reports, and interpretation guides describing each of the downloaded elements and the reports in the templates.

In the case of student data, this system would involve downloading for students in a given program a set of demographic and performance data. The demographic data would include things like address information, sex, and ethnic background. The performance information would include GPAs, cumulative credits, and other summary indicants. Written with commonly used software, the report templates would include programs for mailing labels, dean's lists, uncomplicated probation reports, and a variety of other straightforward list-processing applications.

A mainframe data base, accessed by individual users through a 4GL each time they want to do a report, can also serve this market, but only if access charges are very low. Regardless of whether the delivery system is built around microcomputer software or a mainframe-based 4GL, the development of report templates and detailed interpretive guides to the data elements are the two key activities for institutional researchers wanting to serve the routine clerical market.

The complex clerical market. The market for complex reports on individual cases is growing and represents a good opportunity for institutional reserachers to be of service. In the student data realm, college and departmental offices increasingly want to support effective advising and student service. For instance, they may need an advising report which breaks apart the student's coursework record and compares courses completed with degree requirements. Or the department may need to use complex criteria for identifying students on probation. Parallel examples probably exist in other data realms such as faculty workload and performance.

Users of complex clerical reports typically have unique requirements which can't be totally met by generic templates. Advising and probation reports, for example, often have to incorporate complicated faculty rules involving special GPA and honors point calculations and unusual combinations of coursework.

The complex clerical market is usually best served by production reports or screens using mainframe data bases. The data processing involved in complex clerical reports will often keep a microcomputer running for hours. The programming is complicated and is best done by professional programmers, especially since inefficient programs of this type can be very expensive to run. But even if the programs are ultimately written by computer center staff, there is an important role for institutional researchers in serving this market.

This role is that of "rapid prototyping." Rapid prototyping is a recent data-processing concept (Connell and Brice, 1984) referring to the quick development of iterations of prototypes for production reports. The traditional way of developing production reports has been to go through an exhaustive process of defining external and internal specifications. The advantages of this process are precision and thoroughness, gained at the expense of speed, costs, and flexibility. Too often, the process is completed, the programs are written, and after the first few runs, the user concludes that the program isn't exactly what's needed. The program then has to be expensively modified.

Rapid prototyping replaces the specifications definition process with a trial and error process of quickly developing and running sample reports until they are right. Using extract files and fourth-generation languages, the programmer plunges in and does prototypes until they appear to be right. The advantage of this approach is that the client can see a version of the "real thing" and can test its utility to the application for which it was intended.

Many institutional researchers are well equipped to do rapid prototyping because they know the issues, the data, and the software suited for this activity. They can talk to the user not just about the formats of the report but also about the problems the report will address, the experiences of other universities in dealing with the same problems, the nuances of the data, and alternative ways of accomplishing the task. Institutional researchers are used to working with clients whose needs are diffuse and whose specifications are ambiguous.

The extent to which users can take over the production of the reports once they have been developed will vary with the report. In some cases, prototype 4GL code may be turned over to the users for running on their own. In other cases, it may be more efficient to have computer center staff record the report from stratch in a more difficult but more efficient third-generation procedural language such as COBOL or FORTRAN. In either situation, the institutional researcher's involvement in the prototyping is likely to have improved both the report and the user's understanding of it.

The decision support market. The market for summary statistics is growing, but it is likely to remain smaller than the market for data on individual cases. This market, however, is heavily populated with higher level administrators who are looking for assistance with programmatic decisions. It is, therefore, a very important market.

The paramount requirements for systems to supply summary statistics are speed and applicability to the administrator's decisions. The data have to be the right numbers at the right time or they are of little use. The decision support market is best served by a combination of old and new reporting systems. The old systems are the traditional factbook and research reports, which will always be needed.

The new systems should aspire to meet one of the modern administrator's most frequently stated desires for information services—the push-button report. Administrators with microcomputers on their desks want to be able to spend a few minutes at their keyboards to answer their statistical questions themselves, without having to wait for staff to develop a report. The development of a reporting system to approximate this kind of computer-ad scenario is an appropriate challenge for an institutional research office.

To meet this challenge, one promising resource is the *summary statistics data base*, available either on-line or on disk. Such a data base contains a variety of summary statistics, which can be directly queried and manipulated by the administrator. Several higher education data services have begun to offer comparative statistics on a wide variety of institutional data. The same thing can be done internally on a single campus, as illustrated by a pioneering effort at the University of California, Irvine (Daly, 1985).

If it is well designed, such a data base is likely to be much smaller and more cost effective than giving administrators direct access to large data bases of individual cases. It also has the advantage of being able to include adjusted, official data. Many institutions have to adjust their data categories in order to fit IPEDS or state agency requirements. Sometimes this adjustment process is complicated and takes the reported data a considerable distance from original operational data. As a result, quick ad hoc inquiries often produce different figures from the externally reported figures, a situation which is not appreciated by administrators. Ad hoc queries from a data base of official statistics greatly reduces this problem.

To access the summary statistics data base, there should be a set of "on demand" standard reports. National data services have also developed this concept, offering the same data in the same format, but for selected groups of the requester's choice. For instance, the American College Testing (ACT) Program and Educational Testing Service supply standard marketing and

test score reports for given subsets of a university's applicants. The concept is that the data being reported is always the same, but the selection criteria for the cases being reported on can be varied by the user. For each report, there can be a prewritten interpretation guide and normative data tables.

In the student area, on-demand reports should include demographic profile reports to answer questions such as "What kind of students do we attract from the north metro area?" and academic performance reports to answer questions such as "How well do minority students do compared to students in general?" When questions like these come up, the answers are usually needed very quickly, and decision makers are usually happy to compromise on the exact form of the report in order to get speed.

A set of on-demand standard reports is especially important for the consumers of summary statistics, because even computer-literate administrators often cannot invest the time to become fully adept at using a fourth-generation language system. Even the easiest of query languages is hard to manipulate if one doesn't use it regularly. Preprogrammed reports, accessible through menu picks, on either a microcomputer or mainframe system, are essential to the occasional administrative user. A system of a few on-demand, variable selector reports, using data from a cleaned and official data source, is a good way to add new-style reporting to the institutional research office's response to central administrators.

Summary

The experience at the University of Minnesota has suggested that the market for administrative information can be segmented into submarkets, each requiring different types of systems. These divisions are not mutually exclusive. A given user may be part of all three markets. In some cases, especially at smaller institutions, it may be possible to fashion the single information system that, optimally, meets all three types of purposes (the "ultimate realized data base"). But in other cases, it is likely that a combination of systems will be needed.

Institutional researchers can play a very useful role in shaping computer systems into reporting systems which not only meet the demand for immediate data access but also meet users' deeper needs for intelligible and relevant reports. Most institutional research offices have actually been information centers of a sort, but they have been limited in that they have traditionally served only the summary statistics market with reports generated by their own staff. Distributed computing challenges the institutional research office to expand both its markets and its methods.

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